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INTELLIGENCE REPORT

HISTORICAL NOTES ON THE USE OF AIR POWER AS A WEAPON OF INTERDICTION

DIRECTORATE OF INTELLIGENCE

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FOREWORD

Prior to the current operations in Vietnam, the United States was engaged in three wars in which air power played a major role as a means of conducting offensive warfare. This report summarizes the role of air power in the air wars against Germany, Japan, and North Korea. The analysis of the air wars against Germany and Japan treats in general terms the overall economic effects of the campaign, with somewhat more detailed treatment of the attacks on transportation. The air war against Korea is most similar to the air war being conducted in North Vietnam. For this reason the Korean War is examined in greater detail to evaluate the attempts to interdict North Korea's transport system.

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HISTORICAL NOTES ON THE USE OF AIR POWER AS A WEAPON OF INTERDICTION*

I. The Air War Against Germany

A. THE GERMAN ECONOMY

The German war economy benefited greatly from the German buildup in industrial activity which took place between 1933 and 1939. While both England and the United States entered World War II with substantial unemployment, the German labor force was fully employed by 1939. Six years of rising output (1934-39) meant that substantial investments were made in expanding plant facilities, both for heavy industry and for armament production. One result was that the German armament industry, with few exceptions, worked only single shifts throughout the war and the great reserve capacity available from double or triple shift operations not only gave considerable flexibility but also cushioned the effects of Allied air attacks. In 1938, approximately 30 percent of the national product was already devoted to war expenditures, and this level rose very slowly until, by the end of 1944, approximately 50 percent of the national product was channeled into war purposes.

The output of civilian consumption goods, after the restrictions in the initial war years, was reasonably well maintained so that civilian standards of living continued to be comfortably above the levels of the depression years of the early 1930's.

Germany's dependence on imported raw materials was always looked upon as a classical weakness in wartime. The four-year plan of 1936 was aimed in part at overcoming the most serious of these weaknesses, chiefly through expanded production of synthetic oil, textiles, and rubber. However, Germany imported very substantial percentages of iron ore, copper, manganese, and other metals. Partly as a result of overrunning other Western European sources of supply and

* This report was prepared by the Office of Research and Reports; the estimates and conclusions represent the best judgment of the Directorate of Intelligence as of 15 April 1966.

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partly as a result of substitution, Germany managed until well into 1944 to avoid serious embarrassment from shortages of imported war material. The Germans found that consumption of many materials, such as copper, traditionally believed to be essential to armaments production, could be drastically cut without materially affecting the quality or the usefulness of the end product.

While electric power supplies became tight early in the war, rationing and curtailment of nonessential uses permitted priority needs to be met until 1944. During that year, certain major industrial consumers, such as aluminum producers, were deprived of supplies from time to time on a temporary basis.

In summary, the German economy proved surprisingly able to withstand substantial attacks and still increase munitions output until the weight of Allied bombardment increased to approximately 300,000 tons a quarter, which did not take place until late in 1944 (see Figure 1).

B. OVERALL ECONOMIC EFFECTS OF BOMBING

During 1942 and 1943 the overall effects of air raids on the German economy were small. The US Strategic Bombing Survey estimated that the total loss of German armament production resulting from air attacks carried out in 1943 was not more than 3 to 5 percent, even though the attacks required the Germans to call upon some of their reserves.

In the first four months of 1944 the US air forces concentrated their effort on aircraft plants and on antifriction bearing factories. The vulnerability of these targets proved smaller than had been expected. In May and June of 1944 the weight of attacks on Germany was reduced because of the diversion of a high proportion of the Allied air forces to preparation for the invasion that was launched on 6 June. The air offensive that started later, beginning with attacks on oil and nitrogen facilities and continuing against German transportation, achieved more noticeable results. Before the end of 1944 the output of aviation gasoline and nitrogen had fallen by 90 percent. The attack on transportation was a major factor in reducing the volume of car loadings by 75 percent within five months. However, the index of armament production stayed high. It reached a peak in the third quarter of 1944; the decline in the fourth quarter (from causes other than those attributable to territorial losses) was only about 5 percent.

The Allied bombing program did succeed in tying up a significant portion of the labor force by the third quarter of 1944. An estimated 4½ million workers, or nearly 20 percent of the nonagricultural labor force, were engaged in debris clearance, reconstruction and dispersal projects, the replacement of goods lost through air raids, and in the manning and production of antiaircraft munitions. Air raid casualties reduced the labor force by no more than 500,000 to 700,000, or about 2 percent.

From December 1944 onward, all sections of the German economy were in a rapid decline. This was due to the results of bombing in combination with other causes, particularly the military reverses which had led to the invasion of Germany itself. In February 1945, Silesia and the Saar had been lost, and car loadings were only 11 percent of normal and still falling. The final land actions carrying the Allied armies across the Rhine and Oder Rivers were under way by the time the economy of Germany had ceased to be able to support significant military operations.

C. TARGET SYSTEMS

The greatest weight of Allied air attack, approximately 56 percent, was delivered against two target systems—land transportation and industrial areas (see Table 1). Transportation targets are discussed in D, below.

The attacks against industrial areas, generally identified as city area raids, were primarily the work of the Royal Air Force. It began its famous raids on German urban areas in 1942, with the first thousand-plane raid against Cologne. This was followed by heavy attacks on other industrial cities, the most noteworthy of which were the July

Table 1
Distribution of Bomb Tonnages in the European Theater
During World War II

	PERCENT
Land transportation targets	32.1
Industrial areas	23.7
Military targets	11.1
Oil, chemical, and rubber targets	9.3
Airfields and airdromes	6.9
Naval and water transportation targets	4.2
V-weapon launching sites	2.0
Aircraft factories	1.8
Miscellaneous manufacturing targets	2.6
All other targets	6.3
<i>Total</i>	<i>100.0</i>

and August strikes against Hamburg. The Hamburg raid destroyed about one-third of the residential housing and killed between 60,000 and 100,000 people. While this raid had an immediate shock effect, the city attacks prior to the autumn of 1944 did not substantially affect German war production. Recovery was essentially achieved within a relatively few weeks, and because industrial plants were generally located around the perimeter of German cities, they were characteristically undamaged.

The heavy tonnages of bombs dropped on urban areas as a result of attacks on transportation and targets beginning in September 1944 produced more significant effects. However, since there were so many forces contributing to the collapse of production in the last six months of the war, it has not been possible to assess separately the effect of these later area raids on war production.

1. Civilian Morale

The conclusions of the US Strategic Bombing Survey with respect to the effect of Allied air attacks on German morale are as follows:

The Survey has made extensive studies of the reaction of German people to the air attack and especially to city raids. These studies were carefully designed to cover a complete cross section of the German people in western and southern Germany and to reflect with a minimum of bias their attitude and behavior during the raids. These studies show that the morale of the German people deteriorated under aerial attack. The night raids were feared far more than daylight raids. The people lost faith in the prospect of victory, in their leaders and in the promises and propaganda to which they were subjected. Most of all, they wanted the war to end. They resorted increasingly to "black radio" listening, to circulation of rumor and fact in opposition to the Regime; and there was some increase in active political dissidence—in 1944 one German in every thousand was arrested for a political offense. If they had been at liberty to vote themselves out of the war, they would have done so well before the final surrender. In a determined police state, however, there is a wide difference between dissatisfaction and expressed opposition. Although examination of official records and those of individual plants shows that absenteeism increased and productivity diminished somewhat in the late stages of the war, by and large workers continued to work. However dissatisfied they were with the war, the German people lacked either the will or the means to make their dissatisfaction evident.

The city area raids have left their mark on the German people as well as on their cities. Far more than any other military action that preceded the actual occupation of Germany itself, these attacks left the German people with a solid lesson in the disadvantages of war. It was a terrible lesson.

2. The Attack on the Ball-Bearing Industry

The classic example of an attack on a so-called bottleneck industry was that of the German ball-bearing industry. Not only was ball-bearing production concentrated, with approximately one-half of the output coming from plants in the Schweinfurt area, but also Germany was assumed to need a continuing full supply of ball bearings to continue war production.

Air attacks on Schweinfurt took place on 17 August and 14 October 1943. Losses to attacking German fighters (the plants were outside of escort range) were such that the attacks could not be maintained. During the next four months, when there was a bombing lull, the Germans took energetic steps to disperse the industry. This dispersal was aided by the fact that machine tools were relatively undamaged. Furthermore, it proved possible to eliminate very high percentages of the total number of ball bearings used in some equipment without materially impairing its operation for either civilian or military purposes. The Germans had also exercised the precaution of accumulating substantial stocks. From examination of the records in the ball-bearing industry, and from the testimony of war production officials, there is no evidence that the attacks on the ball-bearing industry had any measurable effect on essential war production.

3. The Aircraft Plants as a Target System

The abortive experience with the ball-bearing industry was followed by renewed attacks on the German aircraft industry. Earlier attacks had the effect of reducing the vulnerability of aircraft assembly plants because the Germans pursued a policy of subdividing and dispersing aircraft production facilities. The new attacks began in February 1944, with the protection of long-range fighter escorts, and were again aimed at aircraft assembly plants as opposed to aircraft engine plants. These attacks did not succeed in reducing the production of aircraft, probably because there was considerable excess capacity in the assembly phase of the aircraft industry and because, once again, relatively simple protective measures prevented serious loss of machine tools. Hence the attack on the ball-bearing industry and the attack on aircraft assembly facilities were proved to be errors in target selection. The German Air Force was defeated, but its defeat came largely as a result of combat operations by the Allied forces. Later in the war the Ruhr steel industry was singled out as a target system,

but because steel lies so deep in the industrial process there is no evidence that these attacks affected munitions production before the end of the war.

4. The Attack on the Petroleum Industry

The attack on the German petroleum industry began in a preliminary way with two strikes in May 1944. These attacks were not followed up, because of the almost complete diversion of air power to attacking tactical targets in preparation for and in support of the D-Day invasion.

The German oil position was tight throughout the war, and production was largely concentrated in 13 synthetic fuel plants. Although there were early attacks on the Rumanian petroleum industry, by August 1944 this source of supply was overrun by the USSR, and German dependence on the synthetic plants became almost complete.

By July 1944, every major plant had been hit. After the attacks began in May, production, which had averaged 316,000 tons per month, fell to 17,000 tons a month in September. Although there was a modest recovery in November and December, the post-attack output was only a fraction of the pre-attack level. Unlike the ball-bearing plants, the synthetic oil plants were attacked again when they were brought back into operation. For example, the largest plant, Leuna, was attacked 22 times by early 1945, and its output from the day of the first attack averaged only 9 percent of capacity.

The effects of depriving Germany of its major fuel resources were almost immediate in terms of military operations. For lack of fuel, pilot training was drastically curtailed, making German aircraft increasingly vulnerable to experienced Allied fighters. As the summer of 1944 wore on, the German panzer divisions were more and more seriously hampered by decreased fuel production. German military stocks of petroleum were so low that when the famous Ardennes offensive (the so-called Battle of the Bulge) was launched, German reserves of fuel were insufficient to support the operation. The German high command counted on capturing Allied stocks to keep the operation rolling. Finally, in February and March of 1945 the Germans massed 1,200 tanks on the Vistula to check the Russian advance. In very short order, the tanks were overrun because they had insufficient fuel for maneuver.

There were other dividends from the attack on the petroleum industry because 60 percent of the nitrogen and 40 percent of the methanol output came from the synthetic oil plants. Shortages of these essential chemicals for munitions were reflected in shortages of ammunition within a few months.

D. THE ATTACK ON TRANSPORTATION

The German transportation system was dominated by the railroads. In combination, the state-owned and privately owned railroads handled three-quarters of all freight traffic and about 70 percent of passenger traffic. Most of the remainder of the freight traffic was accounted for by waterway (largely inland) carriers and less than 3 percent by highway vehicles. The rigid government regulation of trucks was designed to prevent the development of a highway truck system which would compete with the state-owned railways for long-haul business. Therefore, motor transportation was almost entirely limited to local and suburban service.

The rail system was well maintained and had general overcapacity on permanent way, with respect to both lines and classification yards. The inland waterways system connected the important rivers of North Germany; crisscrossed the Ruhr coal area, and provided through water transportation from the Ruhr into the Berlin area. The moderate expansion of the rail system during the war was concentrated in those few places where it was necessary to construct new yards in critical points such as Munich or to parallel vulnerable viaducts with bypass lines.

During most of the air war against Germany the bombing of rail transportation was not given a high priority. Although heavy major ground operations were preceded or accompanied by concentrated attacks on local rail facilities in or near the battle area, transportation was not then selected as a priority target system, because of its size and complexity. As a consequence, the railroads in Germany and the ports of the inland waterways system were subject to only sporadic attacks until the middle of 1944. Heavy attacks on transportation within Germany proper did not begin until September 1944. The recuperative powers of the system were such that until bomb tonnages exceeded 12,000 tons per month the repair system was able to cope with the damage.

At the same time that the heavy attacks were beginning on the railroads, successful attacks on four waterway targets substantially eliminated through traffic on the Rhine and North German canals.

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By 14 October the Rhine River was similarly interdicted at Cologne, and as a consequence the economic traffic of the important Ruhr district fell to about 12 percent of the level of October 1943-March 1944. By the end of December, car loadings had been decreased by about 40 percent and by the first week of March 1945 by almost 80 percent. The index of munitions production held up substantially better than these figures would indicate, largely because of stocks of components and subassemblies.

1. Inland Waterways

The general experience with the attack on waterways was that these were relatively successful in halting traffic—often for a considerable period of time. Furthermore, there were frequent additive side effects such as that resulting from the mining of the Danube River.

The period of intensified mine laying in the Danube was from April to December 1944. The mines (and other aerial attacks) resulted in the sinking of over 40 percent of the Danube cargo fleet. Furthermore, there was a precipitous drop in morale because mine explosions often resulted in the loss of the crew. Consequently, desertions and delays because of manpower shortages were numerous. The tonnage handled on the river dropped about 60 percent within two months and continued to fall throughout the summer. Complete statistics are not available, but the Danube operation was clearly a highly successful one.

2. Railroads

The bomb tonnages dropped on land transportation targets in Germany were as follows, by quarter:

	Tons
1944	
January-March	1,650
April-June	8,250
July-September	19,200 *
October-December	71,000
1945	
January-March	105,000

* Of which 13,000 tons were dropped in September.

It can be seen from the above figures that until September 1944 the tonnages dropped were not sufficient to overwhelm the capabilities of the repair system. Following that date the weight of the attack increased sharply and in the first quarter of 1945 was 64 times that of the first quarter of 1944. The result was a progressive tieup of traffic.

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Although coal traffic (about 40 percent of all the traffic carried by the German railroads) held up better than miscellaneous commercial traffic, the decline was both more easily traceable and more dramatic. The September raids reduced coal-car placements in the Essen Division of the Reichsbahn (the originator of most of the coal traffic of the Ruhr) to an average of 12,000 cars daily, compared with 21,400 at the beginning of the year. Most of this was for consumption within the Ruhr. By January, placements in the Ruhr were down to 9,000 cars a day, and in February 1945 virtually complete interdiction of the Ruhr District was achieved. The German economy was powered by coal and, except in limited areas, the coal supply had been eliminated.

Military (Wehrmacht) traffic had top priority over all other traffic. During the period of attack this traffic came to account for an ever-increasing proportion of the declining movement. Through 1944 the air attack did not prevent the army from originating such movements, although the time of arrival, or even the arrival, of units and equipment became increasingly uncertain. Couriers accompanied detachments and even shipments of tanks and other weapons; their task was to get off the train when it was delayed and report where it could be found. After the turn of the year, even military movements became increasingly difficult. The Ardennes counteroffensive, the troops and equipment for which were marshaled over the railroads, was probably the last such major effort the Reichsbahn would have been capable of in the West.

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II. The Air War Against Japan

At the outset of World War II the Japanese economy was relatively small, approximately 10 percent the size of that of the United States. Despite great efforts to increase the availability of raw materials from domestic sources, Japan was highly dependent on imports to maintain its industrial plant. The acquisition of Manchuria and parts of China helped materially in alleviating Japan's shortages of coking coal, iron ore, and foodstuffs, but negligible quantities of iron ore and bauxite were available within Japan's "inner zone." Plans to develop a synthetic oil industry failed to yield significant results, and Japan was almost wholly dependent on imports from the Dutch East Indies. The same overseas dependence existed for rubber, ferroalloys, and manganese as well as for a variety of other militarily important ferrous and nonferrous materials.

Japan's strategy had been based on the accumulation of munitions, oil, aircraft, and ships which could be thrown into action against essentially nonmobilized enemies. The expectation was that the devastation of the initial blow would result in the enemy suing for peace.

A. THE AIR ATTACKS AGAINST JAPAN PROPER

Most of the tonnage of bombs dropped by Allied forces in the Pacific War fell outside the Japanese home islands. Only one-fourth, or 160,000 to 170,000 tons, was dropped on Japan proper, mostly by B-29's. In contrast, 1,360,000 tons were dropped within Germany's own borders. The air attack on Japan came very late in the war and was very highly concentrated. From June 1944 to January 1945, only 800 tons of bombs were dropped by China-based B-29's on the Japanese home islands. Following the seizure of the Mariannas in August 1944, a series of bases for long-range bombers were constructed, but the tonnage dropped by 9 March 1945 totaled only 7,180 tons.

The basic revision in the method of B-29 attack came on 9 March 1945, when it was decided to bomb the four principal Japanese cities at night with incendiaries. The first attack burned out 15 square miles of Tokyo's most densely populated area. This enormously destructive attack was followed almost immediately by strikes on Nagoya, Osaka, and Kobe. In the aggregate 104,000 tons of bombs were directed at 66 Japanese urban areas, or about two-thirds of the total tonnage dropped on the home islands. Far smaller tonnages

were directed against selected industrial and military targets, as follows: 14,150 tons against aircraft factories, 10,600 tons at oil refineries, 4,708 tons against arsenals, 3,500 tons against miscellaneous industrial targets, 8,150 tons at airfields, and 12,054 mines used in the attacks against shipping.

B. EFFECTS OF THE ATTACKS

The physical destruction resulting from air attacks on Japan was approximately the same as that suffered by Germany. The attacks were more concentrated in time, and the target areas in Japan were smaller and more vulnerable. Japan's defensive capabilities were overwhelmed as was its will and capacity for reconstruction and dispersal. Some 40 percent of the built-up area of the 66 cities attacked was destroyed, and about 30 percent of the entire urban population lost their homes. Total civilian casualties as the result of nine months of air attack, including an estimated 200,000 from the atomic bombs, were approximately 806,000. These casualties probably exceeded those which Japan suffered in combat.

The economic effects of the air attacks are difficult to specify because the loss of merchant shipping had essentially isolated Japan from its sources of industrial raw materials. Most of the oil refineries were out of petroleum, the aluminum plants were out of bauxite, the steel mills were short of ore and coke, and the munitions plants were low on steel and aluminum. Japan's economy was in large measure being neutralized twice over, first by cutting off imports and second by air attack.

The railroad system was not subject to substantial attack and was in reasonably good operating condition at the time of surrender. Japan's electric power system had not been selected as a target system, largely because it existed in numerous small production facilities. Therefore, most of Japan's generating and distribution capacity remained operable. An exception was in the urban areas which had been subject to heavy incendiary attack.

C. CIVILIAN MORALE

The early Japanese military successes, particularly the capture of Singapore, were followed by a wave of optimism and high confidence on the part of the Japanese people. As the war progressed, subsequent defeats were studiously withheld from the people or disguised as strategic withdrawals. The US Strategic Bombing Survey reported that as late as June 1944, in spite of an increasing shortage of food

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and exhausting work to support the war effort, only about 2 percent of the Japanese population believed that Japan faced the probability of defeat. The beginnings of attacks on the home islands coupled with military defeat in the Philippines and a continuing deterioration of food supplies began to be reflected in sharply lowered civilian morale. The survey reported that by June of 1945 nearly one-half of the Japanese people believed that victory could no longer be achieved. One striking effect of air attack on the cities was the mass evacuation which resulted. Roughly one-fourth of the urban population either fled or was evacuated. Progressive lowering of morale was characterized by loss of faith in military and civilian leaders, loss of confidence in Japan's military might, and increasing distrust of government news releases. The interrelationship of military, economic, and morale factors was a complex one, in which the urban attacks had played an important role. It should also be remembered that the effect of the atomic bomb was severe not only on the civilian population but also on the civilian and military leadership.

D. DESTRUCTION OF JAPANESE MERCHANT SHIPPING

Japan's merchant fleet was a key link in supplying home industry with raw materials as well as being vital to the support of armed forces in the field. Approximately 9 million tons out of a total availability of 10 million tons of merchant shipping (including ships of 500 tons and over) was sunk or seriously damaged during the war. About 55 percent of this loss was from submarines and approximately 10 percent from mines, most of which were dropped by aircraft. Most of the remainder fell victim to direct air attack. Thus the role of airpower in the isolation of the Japanese home islands was a major one, even though it was secondary to that of the submarine (see Figure 2).

As a maritime nation with large domestic and foreign trade, Japan had developed a modern merchant marine of first rank. Because shipping was highly developed and heavy industry was located to use fuel and raw materials received by water routes, the railroad mileage was small and the rail system of limited capacity. Only two main rail lines extended the length of Honshu Island. The fleet of large oceangoing ships was complemented by numerous smaller craft engaged in the coastal trade in and around the home islands.

The conquest of Southeast Asia gave Japan control of most of the world's supply of rubber, tin, antimony, jute, and quinine as well as sources for more than enough of its own requirements of petroleum,

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iron ore, bauxite, sugar, corn, and rice. During the war, Japan drew heavily on this area for the bulk raw materials needed by its industry.

Despite a vigorous building program, Japan after 1942 was not able to maintain the prewar level of total tonnage of merchant ships afloat. The December 1941 level was 5.4 million tons of merchant ships, excluding tankers. A year later, this total had been reduced to 5.2 million tons, and by December 1943 the combination of submarine and air attacks had lowered ship availability to 4.2 million tons. The submarine offensive had been particularly stepped up in the fall of 1943.

The year 1944 saw the beginning of the devastating carrier attacks on merchant shipping, originally as a result of the carrier raids on Truk and Palau. A series of operations involving the invasion of the Mariannas and the preinvasion carrier raids around the Philippines followed in the summer and the fall. Sorties against merchant shipping flown by Army, Navy, and Marine land-based and carrier-based aircraft increased from 118,000 in 1943 to 327,000 in 1944. In 1945 the combined sorties reached a monthly peak of almost 51,000 in April. During 1944 the merchant tonnage afloat had been reduced over 50 percent in a 12-month period and was only about 1.5 million tons when Japan surrendered.

Other air operations had a significant effect in reducing the mobility of the shrinking merchant fleet despite Japan's willingness to take severe shipping losses because of its desperate need for strategic imports. The mine-laying campaign conducted by the B-29's early in 1945 not only reduced the total tonnage of merchant shipping but also blockaded certain ports and greatly reduced the serviceability of others.

Oil imports passed their peak in August 1943. The Japanese Navy had lost a significant number of its tankers at Truk, and further sinkings of tankers created desperate shortages of fuel by the fall of 1944. By April 1945, tanker imports ceased completely. Stocks had been drawn down and were quickly exhausted, the fuel supply for the shipping industry began to dry up, and a considerable tonnage of smaller ships was laid up by lack of petroleum. Despite the accumulation of stockpiles of industrial raw materials, even the direct munitions industries suffered serious losses in output as a result of the interdiction of merchant shipping. For example, aluminum output declined 76 percent in a single year as a result of the stoppage of bauxite imports.

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Finally, the nation became short of food. Local production had declined, partly as a result of cutting off imports of fertilizers. Fishing, a major industry prior to the war, was reduced by 50 percent for a variety of reasons, including requisitioning of ships by the Japanese Navy and the shortage of fuel. The situation became so acute by April 1945 that virtually all of the small remaining shipping capacity was diverted to the import of food and salt, sacrificing the trickle of industrial raw materials that had still been flowing in. By April 1945, Japan was essentially isolated. The raw materials base of its economy had been cut off, and the country could look forward only to gradual starvation and increasing military impotence.

E. ACTIONS OF THE ELITE TO END THE WAR

Although in theory the Japanese Emperor was the sole authority, in practice he usually approved the decisions of his advisers. During the early years of the war these advisers were dominated by fanatical army and navy officers. The first definite breach in the political coalition did not occur until Japan's defeat at Saipan. Ten days later, on 16 July 1944, the Cabinet headed by General Tojo fell.

Tojo's government was succeeded by one headed by General Koiso. Despite the original instructions to the Cabinet to give "fundamental reconsiderations" to the problem of continuing the war, Koiso was unable to stand up to the more determined military officers. His major accomplishment was setting up a Supreme War Direction Council which was the inner cabinet group through which the problem of surrender was eventually resolved.

The conviction and strength of the peace party was increased by continuing Japanese military defeats after Saipan and by Japan's inability to defend its airspace against attacks in late 1944 and early 1945. After the US landing on Okinawa in April 1945, General Koiso was replaced by Admiral Suzuki.

In May 1945 the Supreme War Direction Council began active discussions on ways and means to end the war. The Council initiated discussions with the Soviet Union seeking mediation. On 20 June 1945 the Emperor on his own initiative called the Supreme War Direction Council together and ordered it to develop a plan to end the war.

August brought the decisive steps, with the atom bomb falling on Hiroshima on the 6th and the USSR entering the war on the 9th. The Emperor quickly resolved the conflict in favor of unconditional surrender.

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In retrospect, it is clear that, at the highest levels within the Japanese Cabinet, the movement to bring the war to an end began over a year earlier than the date of the final surrender. Japan's surrender cannot be imputed solely to any one of the numerous reversals which jointly contributed to the final decision. The military reversals in the field; the destruction of the Japanese fleet and merchant marine, which isolated the home islands; the surrender of Germany; the destruction caused by incendiary and atomic weapons; and, finally, the Soviet decision to enter the war, all played a part.

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III. The Air War Against North Korea

A. INTRODUCTION

The lessons learned in one war against an adversary using strategy and tactics appropriate to the time and place cannot often be applied with success to another war fought under different conditions. Improved weapons alone can negate the lessons of an earlier war. Furthermore, each war is unique in its total setting—the political and economic realities of a North Vietnam are not those of a North Korea any more than the tropical setting of the former is equal to the harsh climate of the latter.

This section places particular emphasis on the attempts by US aviation forces to interdict the transportation system and to destroy the heavy industry of North Korea. In spite of the differences between North Korea and North Vietnam, these aspects of US operations in North Korea are relevant to current US air operations in North Vietnam.

B. SIMILARITIES AND DIFFERENCES OF ENVIRONMENT

Numerous similarities exist between the present war in Vietnam and the Korean War. Each conflict involves a divided country. Communist China looms over the northern border of both North Korea and North Vietnam as a supplier of war materiel and as a participant or potential participant. Many contrasts exist also. The topographic and climatic settings of the military actions in South Vietnam are unlike those fought in Korea. Instead of the guerrilla and infiltration tactics characteristic of today's war in South Vietnam, the Korean War eventually involved large-scale land armies.

Other contrasts can help put the two conflicts in perspective. North Korea occupies an area of about 47,000 square miles and in 1953 had a population of 9 million; North Vietnam has an area of 61,000 square miles and a population of 18 million.

C. INTERDICTION IN NORTH KOREA

1. Introduction

In the summer of 1951 as talks about a truce began and the fighting lulled, the US Eighth Army calculated that enemy forces in Korea were stockpiling daily 800 tons of supplies behind their lines. It was

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feared that the enemy would "reach a degree of preparedness previously unparalleled in the Korean War." To interfere with this buildup, the Far East Air Force (FEAF) planned Operation Strangle, a comprehensive interdiction campaign against North Korea's railroads and highways.

Operation Strangle had two principal objectives: (1) the knocking out of the North Korean rail system by maintaining continuing rail cuts at numerous points and by destroying rolling stock and equipment, and (2) the disrupting of rail services so that the North Korean and Chinese Communist forces would have to use the highways, which could be brought under effective attack, to transport most of their military supplies.

Postmortems on Operation Strangle have claimed that the codename was an unfortunate choice because it implied more than had been intended. Nevertheless, that name mirrors initial Air Force optimism about the probable effectiveness of an interdiction program. For example, one official statement at the beginning of Operation Strangle claimed:

The Fifth Air Force and attached units in conjunction with US Naval Air units and FEAF Bomber Command have the capability of destroying the enemy's rail system in North Korea, and of hindering his highway transportation system to such an extent that he will not be capable of opposing the US Eighth Army effectively.

Starting in August 1951 and extending over the next 11 months, 81,600 interdiction and armed reconnaissance sorties were flown by the USAF, and more than 104,000 tons of bombs were dropped during the interdiction and armed reconnaissance sorties.* By contrast, in a similar time period (February-December 1965) in North Vietnam, 27,900 sorties were flown and 34,300 tons of bombs, napalm, and rockets were expended against fixed and armed reconnaissance targets. During Operation Strangle an average of almost 10,000 tons of bombs were dropped monthly. The peak month for Rolling Thunder occurred in December 1965 when 5,500 tons of bombs, napalm, and rockets were expended. A summary comparison of air operations in the Korean War and in North Vietnam (Rolling Thunder) is presented in Table 2.

* Because of its unfortunate codename, there was considerable controversy (during the Korean War) about the timespan covered by Operation Strangle. The time limits used are those contained in the official Air Force history. Thus Operation Strangle (later Operation Saturate) began in August 1951 and continued through June 1952.

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Table 2

Comparison of Air Operations in Korea and North Vietnam

	KOREAN WAR *		NORTH VIETNAM
	Entire War June 1950-July 1953	Operation Strangle August 1951-June 1952	Rolling Thunder February-December 1965
Sorties			
Total.....	710,886	214,485	N.A.
Total combat ^b	461,554	144,724	N.A.
Total interdiction and armed reconnaissance ^c	220,168	81,613	27,932 ^d
Total combat expenditures			
Bombs (tons).....	386,037	118,207	N.A.
Napalm (tons).....	32,357	4,313	N.A.
Rockets (rounds).....	313,600	50,707	N.A.
Expenditures for interdiction and armed reconnaissance			
Bombs (tons).....	218,448	104,115	34,261
Napalm (tons).....	3,815	2,192	
Rockets (rounds).....	97,885	30,492	
Damage ^e			
Bridges			
Destroyed.....	1,153	223	161
Damaged.....	3,049	763	432
Tunnels			
Destroyed.....	65	41	N.A.
Damaged.....	939	257	N.A.
Locomotives			
Destroyed.....	963	272	6
Damaged.....	1,171	345	6
Freight cars			
Destroyed.....	10,407	3,638	227
Damaged.....	22,674	7,069	592
Railroad cuts.....	28,621	24,251	N.A.
Trucks and other vehicles			
Destroyed.....	82,920	33,210	483
Damaged.....	33,131	14,768	565
Buildings			
Destroyed.....	118,231	9,109	1,837 ^f
Damaged.....	88,461	17,382	2,266 ^g

Table 2 (Continued)

Comparison of Air Operations in Korea and North Vietnam (Continued)

	KOREAN WAR ^a		NORTH VIETNAM
	Entire War June 1950-July 1953	Operation Strangle August 1951-June 1952	Rolling Thunder February-December 1965
Damage (Continued)			
Oil storage tanks			
Destroyed.....	16	0	N.A.
Damaged.....	3	0	N.A.
Barges and boats			
Destroyed.....	593	225	460
Damaged.....	821	284	753
Aircraft			
Average inventory			
Bombers, light.....	192 ^a	150 ^b	
Bombers, medium.....	118 ^a	103 ^b	
Fighters.....	1,511 ^a	982 ^b	
Operational losses ⁱ			
B-26.....	168	57	
B-29.....	57	24	
F-51.....	300	98	
F-80.....	277	67	
F-82.....	11	2	
F-84.....	249	121	
F-86.....	184	66	

^a Excluding sorties flown by the US Navy and Marines and by other friendly forces. During the Korean War, Navy and Marine aircraft flew 275,912 combat sorties: 204,995 offensive, 44,160 defensive, and 26,757 reconnaissance. Ordnance expenditures were 178,399 tons of bombs and 274,189 rounds of rockets. Navy aircraft were heavily engaged in Operation Strangle, but no specific data, comparable to USAF statistics, are available.

^b Including close support, strategic, counter-air-offensive, counter-air-defensive, reconnaissance, and interdiction and armed reconnaissance, but excluding combat support sorties such as rescue, cargo, and tactical control.

^c A mission with the primary purpose of penetrating enemy lines and destroying or damaging traffic, communications, and movement significant to the enemy's military operation in a given area.

^d Including 6,928 sorties against fixed targets and 17,129 armed reconnaissance sorties.

^e In addition, Navy and Marine aircraft destroyed during the Korean War: 2,005 bridges, 391 locomotives, 5,896 freight cars, 7,437 vehicles, and 44,828 buildings.

^f Barracks, warehouses, and miscellaneous buildings.

^g Peak average inventory, April-June 1953.

^h Average inventory, July-September 1951.

ⁱ In addition, 564 Navy and Marine aircraft were lost to enemy action between 25 June 1950 and 27 July 1953.

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Operation Strangle was not, however, the first US attempt at interdiction in Korea. In the first year of the Korean War the Air Force had flown 70,000 interdiction and armed reconnaissance sorties out of a total of 140,000 combat sorties, but the fluid military situation had required that major emphasis be given to close support of combat troops.

2. Railroad Interdiction—Operation Strangle

For the first three months, Operation Strangle was successful. Major rail lines were disrupted, and fighter-bombers destroyed railroad track faster than the enemy could rebuild it. By early October 1951, rail movements ceased, even on the double-tracked line from the capital of P'yongyang south to Sariwon just north of the battle zone. By November 1951, virtually all direct major rail routes to Manchuria had been severed, although limited serviceability existed by shunting traffic inland and then back to either coastal or other interior rail lines. Interdiction and armed reconnaissance accounted for more than 60 percent of all combat sorties from the start of Operation Strangle through the end of 1951. The number of sorties flown and bomb tonnages expended reached a peak in October, when 9,700 interdiction and armed reconnaissance sorties were flown and more than 10,000 tons of bombs were dropped. In the first two months of Operation Strangle, interdiction and reconnaissance targets claimed more than 90 percent of the total weight of bombs dropped.

These attacks reached a peak of destructiveness in September through November 1951. In September, Air Force pilots alone claimed the destruction of 38 locomotives, 558 freight cars, 5,400 vehicles, and about 1,400 buildings. Rail lines were severed about 15,000 times.*

Immense damage was done to the transportation system of North Korea, even when allowance is made for the exaggerated claims of destruction. The first intense blows did not knock out the system, however, and in the following months the serviceability of the North

* The official USAF Historical Study of Air Operations in the Korean War recognizes that pilots' claims of vehicles destroyed were greatly exaggerated, the results of night attacks being especially hard to evaluate or check. In September 1951 the Fifth Air Force issued a directive permitting night intruders to claim enemy vehicles destroyed only when the vehicles were seen to burn or explode. Yet even this requirement probably did not prevent multiple claims. For example, North Korean truck drivers carried oily rags which were lighted when they were under attack to feign destruction and be spared further attack. Eventually, claims of locomotive "kills" were allowed only when attacks were made using 500-pound bombs or larger and after which the locomotive was observed to be derailed or in at least three separate parts.

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Korean transport system improved materially. Tonnages being moved on the railroads and highways were only a small fraction of peacetime "capacity," but the supplies getting through were more than sufficient to support the Communist armies in the field. The North Koreans and Chinese developed an increasing capability to repair damage from air attacks and to get both rail and highway traffic moving again. Repairs were being made so rapidly that by late December 1951 the Fifth Air Force recognized that "the enemy had broken our railroad blockade of P'yongyang and . . . [has] won the use of all key rail arteries."

In February 1952, Operation Strangle (renamed Operation Saturate) was modified to reflect the lessons of the previous six months. Railroad interdiction was still emphasized, but attacks were concentrated against specific pre-targeted segments of the rail line. The change in air operations, and its successes and failures, can be seen in a description of one attack made against the rail line between Chongju and Sinanju. In a leadoff attack in late March 1952, 307 fighter-bombers dropped 530 1,000-pound bombs and 84 500-pound bombs. The following day, 160 fighters dropped 322 1,000-pound bombs. During the night, B-26's dropped 42 500-pound bombs on what had already become a major gap in the rail line. However, the ability of the North Koreans to repair rail damage had further improved; within six days the roadbed was almost completely rebuilt and the tracks were replaced. The 48-hour attack and the expenditure of 450 tons of bombs had interdicted the rail line for 6 to 7 days but had required the commitment of almost the entire fighter-bomber force. At the same time other rail lines had remained open.

In April 1952 a penetrating staff study by the Air Force recognized that in spite of the vast damage inflicted the interdiction operation had not achieved its objectives and that such operations were becoming more costly in terms of casualties to air crews and aircraft lost and damaged. Furthermore, some of the most modern US weaponry was being effectively countered by hordes of unskilled labor and minimum amounts of easily attainable materials.

Policy changes which emerged from the staff study emphasized the need to inflict maximum damage on the enemy and to minimize US losses, and included some shifts in targets. Thus, while locomotives, motor vehicles, and other transportation targets were still rated as prime targets, equal or greater emphasis was given to radar, guns, supply depots, mines, powerplants, and military schools. In

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effect, the new targeting took account of economic principles. From attempts to physically cut the rail and highway systems the attack moved to inflict maximum damage upon the enemy's limited stock of military and transport capital in North Korea, capital which could not be replaced by the labor of unskilled peasants. Nevertheless, the new attack policy, announced in July 1952, admitted that "obstruction of enemy supply movement in Korea cannot prevent the enemy from gradually building up his stockpile." Although the Air Force continued to bomb selected bridges and rail targets during the remaining year of the war, Operations Strangle and Saturate were at an end.

3. Evaluation of Operation Strangle

a. Introduction

Operation Strangle and Operation Saturate failed to achieve their major objectives not only because there was an insufficient number of aircraft to maintain an adequate number of rail cuts but also because enemy countermeasures were more successful than had been estimated. Communist antiaircraft defenses increased markedly, and the Communists showed an increasing ability to improvise repairs, to build bypass lines, and to mass peasant labor to maintain and repair essential supply lines.

The decline in returns from Operation Strangle can be seen from an analysis of bombs expended and damage achieved. During July 1951, the month before Operation Strangle got under way, approximately 6,600 tons of bombs had been dropped on interdiction targets in North Korea. Bombs expended increased sharply in August to 8,300 tons. From August to September, bombs expended increased by about 2,000 tons, or one-fourth, and the estimated value of destruction increased by about three times. After November, however, there was a steady trend of diminishing returns from the bombing attacks despite a fairly steady expenditure of bombs at an average rate of 9,800 tons per month. As shown in Figure 3, the index of value of damage per ton of bombs declined from a peak of 100 in September 1951 to 39 in January 1952 and a low of about 26 in April and June.

The combination of decreasing returns from air attack and the sustained capability of keeping supply lines open meant that the North Koreans and Chinese in defensive positions were able to move in their daily logistic requirements and to make significant additions to stockpiles. They were, however, unable to mount a sustained offensive, because of the supply ceiling imposed by air attack.

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b. Railroad Interdiction

During 1950-53 the North Korean rail system consisted of about 2,300 miles of line, largely standard gauge, and included approximately 1,800 bridges and 400 tunnels. During the initial stages of Operation Strangle the Air Force engaged in a multiprong attack against bridges, rolling stock, tunnels, roadbeds, and rails. Tunnels, used extensively to protect trains and supplies in daytime attacks, proved in most instances to be impossible to destroy. Bridges were difficult targets, but were destroyed consistently.

After the interdiction campaign had been under way for several months the enemy showed a rapidly increasing capability to restore damaged bridges. Construction materials were being stockpiled near key bridges even before US attacks. Simple bypass bridges were built frequently in from 2 to 4 days. Rail cuts were repaired in from 2 to 6 hours. Priority was placed on getting a bridge back in partial operation so that some supplies could begin to flow again although traffic might remain far below capacity levels.

The North Koreans and Chinese stationed railroad construction troops along all main supply routes which were under attack. Units of 50 troops were located at all major rail stations, and crews of 10 men were located every 4 miles along the route. In addition, rail walkers spotted damage to the rail or roadbed. Nearby inhabitants were recruited for common labor, and sometimes as many as 1,000 persons were used to repair a damaged section. At dark, experienced railroad construction crews would move in and make the actual repairs to the rail line. Furthermore, in portage-like operations, rail service was maintained on very short stretches of usable track—as short as 11 miles—and freight was unloaded, carried around rail cuts or damaged bridges, and then reloaded on another train.

c. Highway Interdiction

The road network in North Korea, originally developed by the Japanese, had always been of secondary importance to the railroads. Trucks had been used typically for short hauls and served as links between industrial and commercial centers and the major railroads. North Korea's principal highways roughly followed the major rail routes from Manchuria southward. Altogether about 10,000 miles of highways existed, at best surfaced with gravel or crushed stone.

Although the major interdiction effort of Operation Strangle was against the North Korean rail system, attacks against trucks were also pressed, especially night attacks led by B-26's. On one occasion, an

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Air Force wing reportedly sighted 3,800 motor vehicles and attacked 2,600 vehicles in one day. The Air Force claimed that 6,400 trucks were destroyed in October 1951 alone. Highway bridges were also attacked but proved to be more difficult to interdict effectively than rail bridges. Bypasses were sometimes built at a considerable distance from the original bridge and were thus not easily sighted; fords were built and used during much of the year.

Truck traffic was uncommon during the daylight hours and at night was hard to locate and to attack effectively. The results of night attacks against motor vehicles as well as rolling stock were especially difficult to assess. Trucks usually traveled in convoys of 15 to 20 vehicles, ordinarily under blackout conditions. The mileage norm for trucks per night was about 60 miles. For example, a round trip from the Manchurian border to the battle zone required about 10 nights' travel.

d. Night Operations

Even before Operation Strangle began, the North Koreans had started to move virtually all rail and road traffic at night. The B-26 bomber was used extensively as a night intruder to harass trucks and trains along major enemy supply routes. During Operation Strangle, 1,500 to 2,000 sorties were flown monthly by B-26 bombers, about 90 percent of them at night. The heavier B-29 bombers were used to attack targets at night.

In the absence of bright moonlight, B-26 attacks achieved only limited success, and numerous experiments were conducted with flares to light the targets. Infrared detection systems were used on a limited scale to locate targets such as locomotives, tanks, vehicles, and industrial locations. The results of these innovations were limited, however.

In 1952, as Operation Strangle disrupted railroad lines, the North Koreans and Chinese made more intensive use of trucks to transport supplies to the front. In the fall and winter months, sightings of vehicles declined, and the B-26 night attacks were shifted to rail cutting and to harassing North Korean night repair activities.

The major lessons from US night-intruder operations during the Korean War were the following: (1) aircraft, especially the B-26 that had been designed for day operations, had only limited success at night in detecting, identifying, and attacking moving targets; (2) air crews required careful selection and special training for night operations; and (3) a strong need existed for a family of "denial" weapons that

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would successfully interdict rail lines and highways for periods that would eliminate the need for essentially inefficient night operations. Night operations were hampered throughout by the inadequacy of night photography to provide adequate assessment of bomb damage.

e. *The Wa-dong Chokepoint*

The Korean War offers an excellent example of the difficulty of successfully interdicting a transportation chokepoint by large-scale aerial bombing. In the winter of 1952, while Operation Saturate was getting under way, target specialists located what appeared to be a vital chokepoint near the village of Wa-dong in central Korea about 20 miles north of the 39th parallel. Here a major east-west railroad passed over a highway from Wonsan on the east coast to the capital at P'yongyang. About 100 yards further to the west the railroad entered a short tunnel. The railroad and highway did not follow identical alignments across North Korea but came together only at Wa-dong. Adjacent hills rising to about 300 feet above the valley floor would have made Wa-dong stand out as an ideal chokepoint to even the most unimaginative target analyst. The North Koreans had used both the lateral highway and the railroad to shuttle supplies between the east and west coastal railroads, thus substantially increasing the flexibility of the badly damaged rail system. The objective of the attacks was to block all rail and vehicle movement in the area. Due to the area's rough terrain, bypassing the chokepoint would have proved very costly.

For 44 days, from 26 January to 11 March 1952, 77 B-29 and 126 B-26 sorties saturated the target of about 18 acres with 3,928 500-pound general-purpose bombs, one bomb for every 22 square yards of target. Bomb assessment reports for 24 days of the 44-day attack period showed the following results:

Railroad

Serviceable	10 days
Unserviceable	8 days
Status unknown	6 days
<i>Total</i>	<i>24 days</i>

Highway

Serviceable	15 days
Unserviceable	4 days
Status unknown	5 days
<i>Total</i>	<i>24 days</i>

Bomb assessment reports also revealed that the total effort had resulted in only 18 actual rail cuts and 15 highway cuts. The effort

at best resulted in the railroad being interdicted for 8 days and the highway for 4 days. Except for temporary disruptions the North Koreans had suffered very little damage. The bombs had done little more than churn up the countryside; landslides that had been hoped for did not occur.

Evaluations made of the Wa-dong experience during the Korean War led to the conclusion that it is a fallacy to assume that there is an "area target" for traffic interdiction, and the Far East Air Forces recommended that airpower be concentrated on pinpoint bombing against definite targets in preference to area bombing in any future interdiction attacks.

D. STRATEGIC BOMBING

1. Early Bombing

North Korea's modern industry, which was developed by the Japanese, was considerably greater in total capacity and range of output in 1950 than North Vietnam's industry in 1965. During the initial months of the Korean War the B-29's available in the war theater were engaged in close tactical support of the hard-pressed US and South Korean forces. Attacks on industrial targets in North Korea were not feasible until mid-July 1950. In the next three months the FEAF Bomber Command dropped 10,400 tons of bombs, with excellent results, on the major targets listed in Table 3. Of 20 strategic targets designated by the JCS, 18 had been destroyed or severely damaged by the late September.

In September 1950, plans were under way to destroy the modern complex of hydroelectric generating plants that had been built by the Japanese. On 26 September, 17 B-29's attacked and inflicted minor damage on the Pujon Hydroelectric Plant, which had an installed capacity of 128,000 kilowatts. The same day, however, the JCS suspended attacks on strategic targets.

By late September the Commander of FEAF was able to claim, "Practically all of the major military targets strategically important to the enemy forces and to their war potential have now been neutralized." In a few weeks, North Korea's modern industry had been destroyed. Although such destruction obviously inflicted "punishment" on North Korea's leadership, the military effect of the strategic bombing was of little consequence. Military equipment and ammunition continued to flow into North Korea from China and the USSR.

Table 3
Strategic Targets Attacked in North Korea
1950

Location	Target	Bomb Tonnage	Percent of Target Destroyed or Damaged
Wonsan.....	Dock area.....	244	50
	Locomotive shops.....	372	70
	Railroad yards.....	477	70
	Chosen oil refinery.....	327	95
Hungnam.....	Bogun Chemical Plant.....	695	70
	Chosen Nitrogen Fertilizer Company..	563	85
	Chosen Nitrogen Explosives Company..	500	85
P'yongyang.....	Arsenal.....	99	70
	Kan-Ni.....	500	15
	Shunting yards.....	356	30
	Railway shops and yards.....	584	70
Chongjin.....	Harbor and submarine base.....	249	5
	Mitsubishi.....	132	30
	Iron works.....	203	20
	Railroad yards and shops.....	1,063	55
Rashin.....	Oil storage.....	49	Negl.
	Dock area.....	218	Negl.
	Railroad shops and yards.....	110	Negl.
Chinnampo.....	Marshaling yards.....	121	80
	Port and submarine base.....	5	Negl.
	Mining and smelter.....	248	35
	Chosen Riken Metals Co.....	284	70
Changjingang Reservoir.	Pujon Hydroelectric Plant No. 1.....	39	10
Hamhung.....	Railway shops and yards.....	547	70
Haeju.....	Chosen Nitrogen Explosives Company.	568	10
	Railway shops and yards.....	104	70
Kyomipo.....	Iron works.....	252	40
	Marshaling yard.....	23	Negl.
Kowon.....	Railway shops and yards.....	102	10
Songjin.....	Steel works.....	326	90
	Magnesite Chemical Industry.....	183	30
	Railway shops and yards.....	280	60
Yangdok.....	Railway shops and yards.....	75	85
Namgunngni.....	Storage area.....	58	80
Munpyongni.....	Rising Sun Oil Storage.....	2	*
Chongju.....	Railway shops and yards.....	170	10
Kilchu.....	Marshaling yards.....	99	50
Sunchon.....	Chemical industry and marshaling yard.	138	30
Sariwon.....	Marshaling yard.....	81	50
<i>Total.....</i>		<i>10,446</i>	

* No bomb damage assessment.

2. Later Strategic Bombing Efforts

a. *Hydroelectric Power*

It was not until June 1952 that the hydroelectric installations previously regarded as "politically sensitive" targets were again considered as legitimate targets. Over a 3-day period in June 1952, 730 fighter-bomber sorties by the Fifth Air Force, supported by sorties from a Navy Task Force, were flown against the power complexes, including the Sui-ho Generating Plant on the Yalu River. Poststrike evaluation of the bombing attack indicated that 90 percent of North Korea's electric power capacity had been knocked out. For more than two weeks there was almost a complete blackout in North Korea until small thermal plants and undamaged hydroelectric plants restored a small portion of North Korea's pre-attack capacity. Although the small, dispersed "war-industries" in North Korea obviously suffered from the loss of electric power, the extent of the damage to industry in Manchuria, which received much of its electric power from North Korea, was difficult to assess.

Attacks against the hydroelectric installations came much too late in the Korean War to have much impact on the outcome or to do serious damage to North Korea's war effort. The attacks were designed primarily to exert continued air pressure on the North Koreans and Chinese to accept UN truce proposals.

b. *Irrigation Dams*

In the spring of 1953, only slow progress was being made at the Panmunjom truce talks. Air Force targets specialists seeking additional means of increasing air pressure against the Communists recognized the importance of the irrigation dams to Korean rice production. There followed a large-scale and highly successful attack against a 2,300-foot earth and stone dam about 20 miles north of P'yongyang. Along with severe damage to a major rail line, the floodwaters also damaged 5 square miles of prime rice crops.

Other Korean dams were attacked by US fighter-bombers and B-29's, ostensibly to interdict transportation lines. These later attacks were less successful because the North Koreans, as in other circumstances, improvised countermeasures. For example, by rapidly lowering the water level the North Koreans made it much more difficult to destroy or seriously damage the dams.

E. LESSONS FROM THE KOREAN WAR

1. Introduction

The 27,900 strike sorties flown and the 34,300 tons of bombs, napalm, and rockets expended under the Rolling Thunder program from February through December 1965 are less than one-third the 81,600 sorties flown and the 104,000 tons of bombs dropped by the Air Force during the interdiction and armed reconnaissance sorties in the 11 months of Operation Strangle. In addition, during the Korean War Navy and Marine aircraft operating from carriers probably also dropped about one-third as much tonnage as was dropped by the Air Force on interdiction targets.

Even allowing for exaggerated damage claims, it is clear that there were far more lucrative targets in North Korea than are being located and destroyed presently in North Vietnam. Destruction claimed in the 11 months of Operation Strangle in Korea compared with that claimed for Rolling Thunder in Vietnam through December 1965 is shown in the following tabulation:

	<u>OPERATION STRANGLE</u>	<u>ROLLING THUNDER</u>
Locomotives	272	6
Freight cars	3,638	227
Vehicles	33,210	483
Bridges	223	161
Buildings	9,109	1,837
Barges and boats	225	460

The greater destruction achieved in Korea compared with North Vietnam is not solely a function of the number of sorties and the tonnage of bombs dropped. The Rolling Thunder program has had to operate under policies which sharply limit both the areas in which it can operate and the targets it can attack. North Korea's railroads and highways had to supply almost 1 million troops, 600,000 of whom were at the front. North Korea had almost 2,300 miles of rail lines and 10,000 miles of highways, compared with North Vietnam's meager 485 miles of rail lines and 5,800 miles of highways. North Korea had a much larger park of both rolling stock and trucks. In addition, although the population of North Vietnam substantially exceeds North Korea's, there was more modern and semimodern industry in North Korea than is found in North Vietnam.

2. Failure of the Interdiction Campaign

At the time Operation Strangle was under way, it was estimated that each Chinese division required 50 tons of supplies per day.* With

* About 48 percent food; 22 percent clothing, weapons, and equipage; 10 percent POL; and 20 percent ammunition.

60 divisions at the front, approximately 3,000 tons of supplies had to be moved from Manchuria to the battlefield each day.

Peacetime capacity of the double-tracked line in western Korea from Sinuiju to P'yongyang was estimated to have a capacity of from 6,000 to 9,000 tons per day. After maximum interdiction efforts, it was conservatively estimated that only 500 to 1,500 tons per day were getting through to the battle zone. The capacity of the east coast rail line, 5,000 tons per day in peacetime, was reduced to less than 500 tons per day. Thus railroads were still able to transport about one-half of the daily requirements. In addition, the North Koreans and Chinese also relied heavily on trucks and on peasants carrying supplies strapped to A-frames and even bicycles for moving supplies to the front. A staff study completed in April 1952 by two Air Force officers concluded that after seven months of maximum US effort the Communists still were more than meeting minimum supply requirements. The study concluded that the accepted figure for the enemy's minimum supply requirements was 2,700 tons per day under existing conditions but that more than this amount was being received. The staff study also stated that over and above daily requirements the enemy had been able to stockpile approximately 100,000 tons, or a 37-day supply, during the seven months of the rail interdiction program. This capability was, however, not sufficient to permit the North Koreans and Chinese to mount sustained offensive operations.

Another logistics study from the Korean War illustrates how difficult it is to prevent what was called "seeping resupply." During three months in the winter of 1951-52 the Chinese and North Koreans were firing 15,000 mortar shells per month, or 500 shells a day. Each shell weighed 10 pounds; thus it was possible for a peasant to carry five of them on an A-frame. One hundred peasants arriving at the front from supply depots in the rear could supply all the enemy's daily needs for mortar ammunition. One truck a day could replenish the supply depots.

Operation Strangle clearly did great damage to the transport system of North Korea and conceivably prevented Communist China from mounting additional large-scale offensives in Korea. At the same time, it is also clear that the Chinese and North Korean troops received sufficient logistic support to contain the offensive pressures exerted by the Eighth Army. In short, the defensive capabilities of the Chinese and North Koreans showed no sign of collapsing as a result of the interdiction campaign, and indeed the enemy was able to mount sharp battalion-size attacks on occasion.

The air interdiction campaign failed to deny Communist forces the supplies they needed to contain the US Army because the North Koreans and Chinese were able to take effective countermeasures. One major lesson that emerged from the Korean War was that US planners underestimated the effectiveness of the enemy countermeasures. The North Koreans and Chinese showed increasing rapidity in rebuilding damaged rail and road bridges and other key installations. Choke-points, often given exaggerated importance, were frequently bypassed without undue enemy effort. Darkness shrouded most of the enemy's movements from effective attack. A major lesson of the Korean War was the clearly demonstrated need for the development of a family of weapons that could successfully interdict night railroad and highway traffic.

3. Air Pressure Tactics and Psychological Warfare

It is difficult to judge the overall effect of US interdiction and strategic bombing on the will of the political leadership and the morale of the civilian population of North Korea. There are numerous examples, however, of the North Koreans and Chinese responding with effective countermeasures to each new phase of air operations against North Korea. The North Koreans were able to devise effective means to counteract the program of massive rail interdiction. The North Korean response to the bombing of irrigation dams also illustrates the tenacity and cleverness with which the Communists met new phases of US air operations.

Claims by some historians that air operations were almost solely responsible for the North Koreans and Chinese initially coming to the conference table and finally signing a truce agreement cannot be substantiated.* The Chinese and North Koreans came to the conference table mainly because their total losses accruing from the war had become greater than their total gains, all military, political, and economic factors considered, including losses from air attacks. US airpower played an important role in convincing the Communists to come to terms, but the evidence does not support the view that airstrikes were the decisive factor.

Because of a host of factors, including the unique nature of UN "police action" in Korea and the uncertain position of US officials about the advantages and disadvantages of psychological air warfare, the

* One Air Force historian, for example, in discussing FEAF operations in Korea in mid-1952, wrote, "the destructive force of FEAF's airpower has broken the stalemate."

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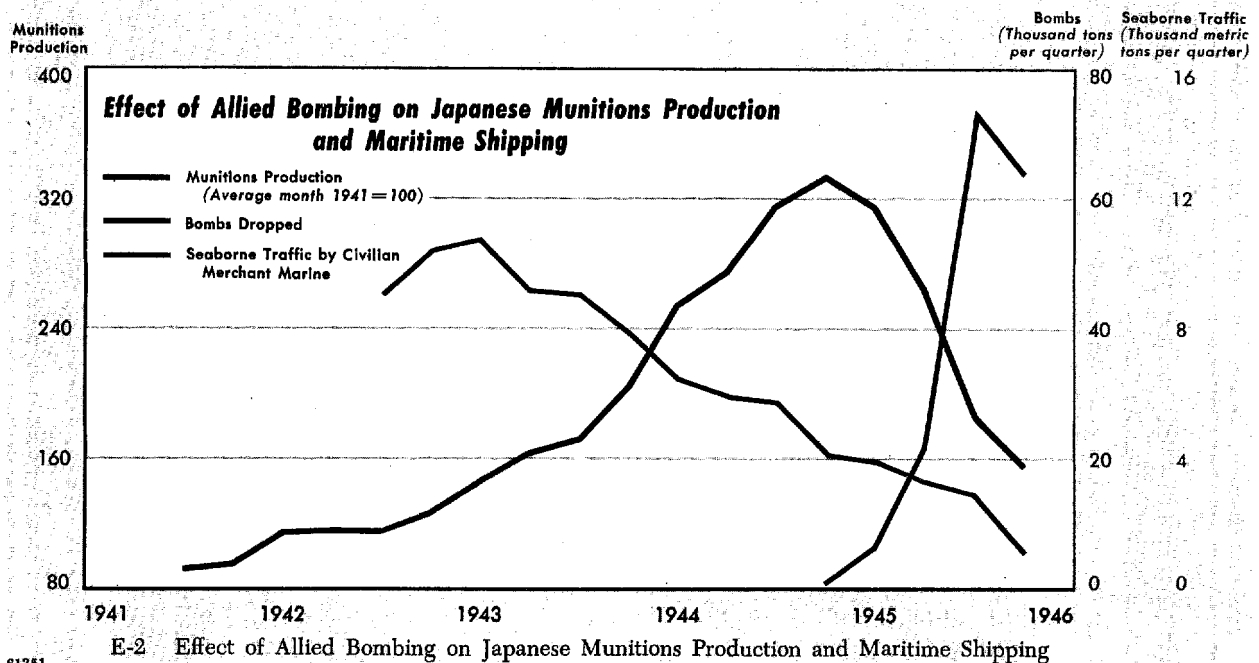
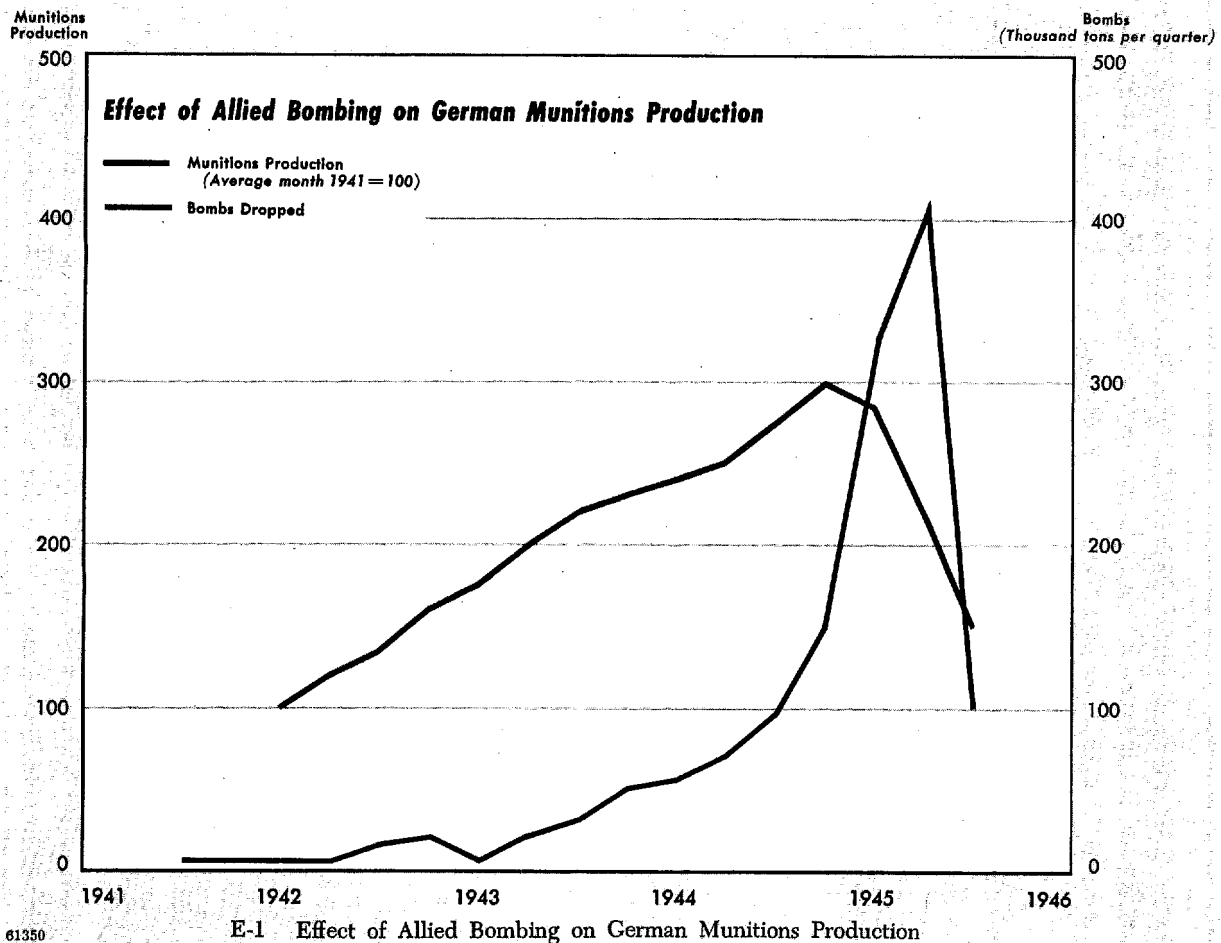
psychological warfare phase of US operations in North Korea was little understood and only intermittently applied.

4. Lessons for Vietnam

The lessons from the Korean War indicate that it will prove difficult to cut off supplies flowing from North Vietnam to South Vietnam. The total daily tonnages needed by the Viet Cong and North Vietnamese regulars engaged in South Vietnam are far less per man than was the case in Korea, largely because most food and clothing supplies are obtained locally in the South. Relatively small numbers of trucks, carts, and human bearers can maintain more than the enemy's minimum requirements unless the Vietnamese war is sharply escalated. Furthermore, the experiences of the Korean War suggest that as long as they continue to receive extensive support from China and the USSR the North Vietnamese are likely to show an increasing capability to improvise countermeasures to circumvent a continuing US air interdiction. The Korean War suggests also that diminishing returns can be expected from continuing air interdiction. At the same time, the increasing effectiveness of conventional antiaircraft weapons and air defense missiles could raise the cost of continuing the campaign. The rebuilding of bridges, the building of bypasses, and the other countermeasures in evidence in North Vietnam in no way suggest a less determined enemy than was encountered in Korea. The primitiveness of North Vietnam—the lack of potentially decisive military and industrial targets—will make it difficult if not impossible for airpower alone to extract a prohibitive price for North Vietnamese intransigence. Only the application of large numbers of new interdiction weapons which are more effective than those that were available in the Korean War would be likely to tip the scales in favor of successful, long-term interdiction.

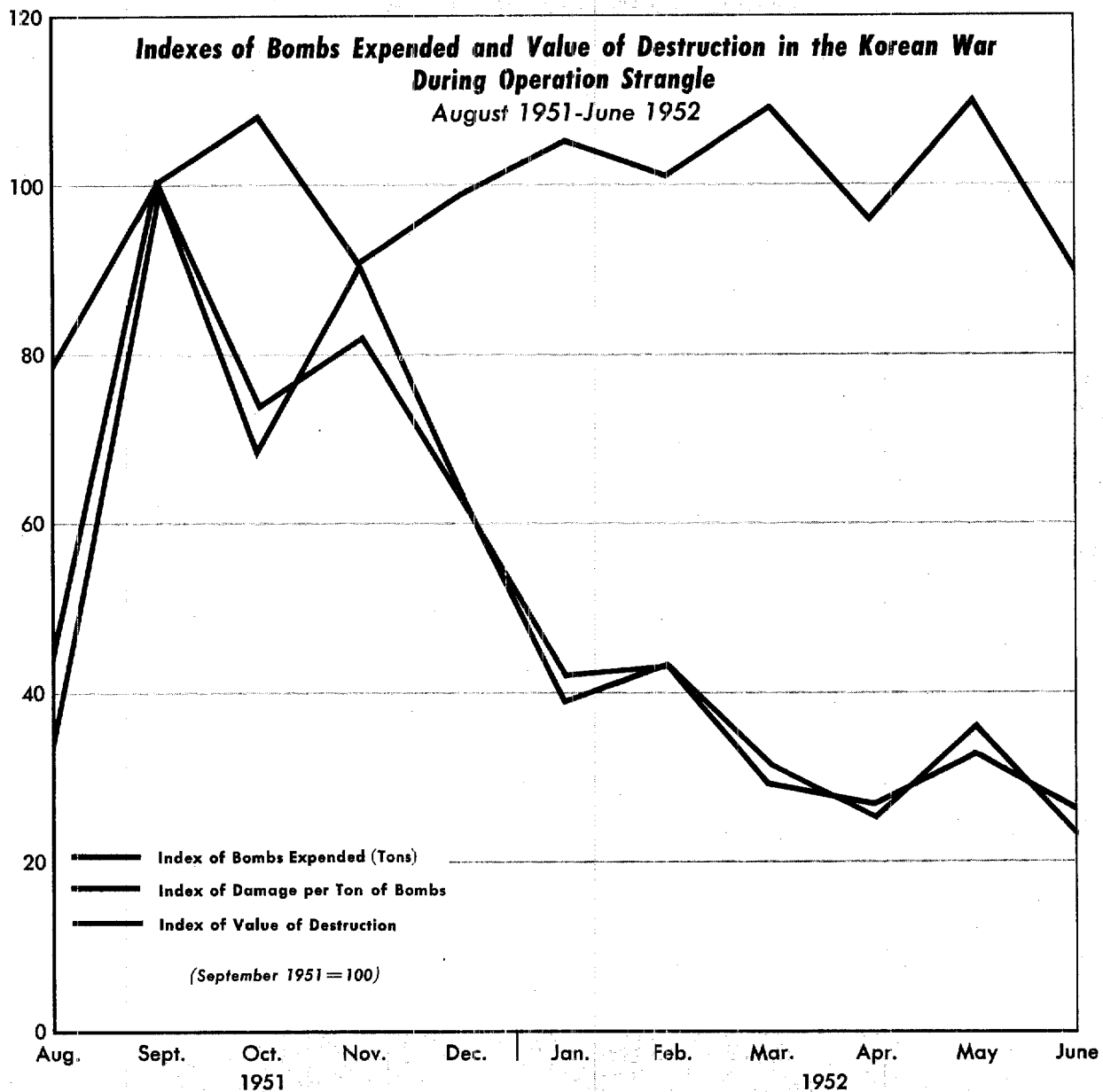
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MEMORANDUM FOR THE DIRECTOR

Mr. Whiting's office in State (Director, O/ Research and Analysis for WE) called to say that they consider ER 66-8, Historical Notes on the Use of Air Power as a Weapon of Interdiction, an excellent report and would like to make wider dissemination of it. They have requested 12 more copies and St/P/C is filling the order. This report was sent to Dir Hughes, INR, over your signature.

Heady

*WH requested an
additional copy for Posten
through [REDACTED]*

19 May 66

(DATE)

FORM NO. 101 REPLACES FORM 10-101
1 AUG 54 WHICH MAY BE USED.

(47)

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TRANSMITTAL SLIP		DATE 23 May 1966
TO: [REDACTED] Ch/D/T		
ROOM NO. 3 G 39	BUILDING Hq	
REMARKS: FYI -- copy placed in ORR Commendation File. Trudy <i>File app E</i>		
FROM: DD/ORR BY-3		
ROOM NO. 4-F-18	BUILDING Hq.	EXTENSION 5001
FORM NO. 241 1 FEB 55		REPLACES FORM 36-8 WHICH MAY BE USED. (47)